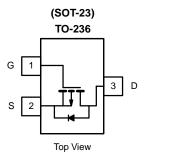


## **APM2309AAC-VB Datasheet**

# P-Channel 30 V (D-S) MOSFET

PRODUC	CT SUMMARY		
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) Typ.	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
	0.046 at V <sub>GS</sub> = - 10 V	- 5.6	
- 30	0.049 at V <sub>GS</sub> = - 6 V	- 5	11.4 nC
	0.054 at V <sub>GS</sub> = - 4.5 V	-4.5	





#### **FEATURES**

- Trench Power MOSFET
- 100 % R<sub>g</sub> Tested



### **APPLICATIONS**

- For Mobile Computing
  - Load Switch
  - Notebook Adaptor Switch
  - DC/DC Converter

Parameter		Symbol	Limit	Unit	
Drain-Source Voltage		V <sub>DS</sub>	- 30	V	
Gate-Source Voltage		V <sub>GS</sub>	± 20	V	
	T <sub>C</sub> = 25 °C		- 5.6		
	T <sub>C</sub> = 70 °C		- 5.1		
Continuous Drain Current ( $T_J = 150 \ ^{\circ}C$ )	T <sub>A</sub> = 25 °C	I <sub>D</sub>	- 5.4 <sup>b,c</sup>		
	T <sub>A</sub> = 70 °C		- 4.3 <sup>b,c</sup>	А	
Pulsed Drain Current (t = 100 µs)	1	I <sub>DM</sub>	- 18		
Continuus Courses Durin Diado Current	T <sub>C</sub> = 25 °C		- 2.1		
Continous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	- 1 <sup>b,c</sup>		
	T <sub>C</sub> = 25 °C		2.5		
Maximum Davias Diasia stian	T <sub>C</sub> = 70 °C		1.6	10/	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	1.25 <sup>b,c</sup>	W	
	T <sub>A</sub> = 70 °C	1	0.8 <sup>b,c</sup>		
Operating Junction and Storage Temperatur	e Range	T <sub>J</sub> , T <sub>stq</sub>	- 55 to 150	°C	

#### THERMAL RESISTANCE RATINGS Parameter Symbol Typical Maximum Unit Maximum Junction-to-Ambient<sup>b,d</sup> $t \le 5 s$ R<sub>thJA</sub> 75 100 °C/W Maximum Junction-to-Foot (Drain) 40 50 Steady State $\mathsf{R}_{\mathsf{thJF}}$

Notes:

a. Based on  $T_C = 25 \text{ °C}$ . b. Surface mounted on 1" x 1" FR4 board.

c. t = 5 s.

d. Maximum under steady state conditions is 166 °C/W.

B	<sup>®</sup> VBsemi
www.V	/Bsemi.com

Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static					•		
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 V, I_D = -250 \mu A$	- 30			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	1 250.04		- 19			
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = - 250 μΑ		4		mV/°C	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}$ , $I_D = -250 \ \mu A$	- 0.5		- 2.0	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 V, V_{GS} = \pm 20 V$			± 100	nA	
	I <sub>DSS</sub>	V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V			- 1	1.	
Zero Gate Voltage Drain Current		V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 5	μA	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \le -5 V$ , $V_{GS} = -10 V$	- 2.5			Α	
		V <sub>GS</sub> =- 10 V, I <sub>D</sub> = - 4.4 A		0.046			
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> =- 6 V, I <sub>D</sub> = - 4 A		0.049		Ω	
		V <sub>GS</sub> =- 4.5 V, I <sub>D</sub> = - 3.6 A		0.054			
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 3.4 A		18		S	
Dynamic <sup>b</sup>	010				ļ	ļ	
Input Capacitance	C <sub>iss</sub>			1295			
Output Capacitance	C <sub>oss</sub>	V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz		150		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>			130			
	Orss	V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5.4 A		24	36		
Total Gate Charge	Q <sub>g</sub>			11.4	17	nC	
Gate-Source Charge	Q <sub>gs</sub>	V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5.4 A		3.4			
Gate-Drain Charge	Q <sub>gd</sub>			3.8		-	
Gate Resistance	Rg	f = 1 MHz	1.5	7.7	15.4	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			13	20		
Rise Time	t <sub>r</sub>	$V_{DD} = -15 \text{ V}, \text{ R}_{1} = 3.5 \Omega$		4	8	_	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong -4.3 \text{ A}, \text{ V}_{\text{GEN}} = -10 \text{ V}, \text{ R}_{\text{g}} = 1 \Omega$		38	57	_	
Fall Time	t <sub>f</sub>			6	12	_	
Turn-On Delay Time	t <sub>d(on)</sub>			28	42	ns	
Rise Time	t <sub>r</sub>	$V_{DD} = -15 \text{ V}, \text{ R}_1 = 3.5 \Omega$		16	24	_	
Turn-Off Delay Time		$V_{DD} = -13 \text{ V}, \text{ K}_{L} = 3.3 \Omega$ $I_{D} \cong -4.3 \text{ A}, \text{ V}_{GEN} = -4.5 \text{ V}, \text{ R}_{g} = 1 \Omega$		30	45	-	
Fall Time	t <sub>d(off)</sub> t <sub>f</sub>			10	20		
Drain-Source Body Diode Characteristic	•			10	20		
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 2.1	1	
Pulse Diode Forward Current ( $t = 100 \mu$ s)	I <sub>SM</sub>				- 80	A	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 4.3 A, V <sub>GS</sub> = 0 V		- 0.8	- 1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	.5		- 0.8	23	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	4		7	14	nC	
Reverse Recovery Fall Time		$I_F = -4.3 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^\circ\text{C}$		8	14		
Reverse Recovery Fall Time	t <sub>a</sub>	J		ō		ns	

Notes:

a. Pulse test; pulse width  $\leq$  300  $\mu s,$  duty cycle  $\leq$  2 %.

b. Guaranteed by design, not subject to production testing.

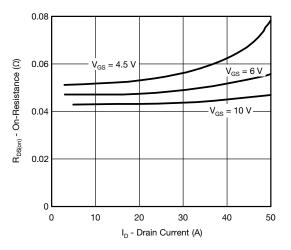
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.







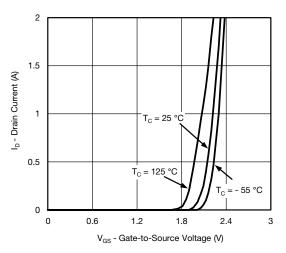
**Output Characteristics** 



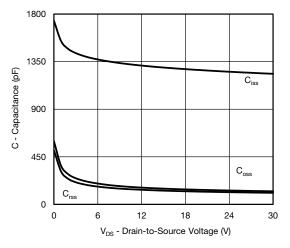
**On-Resistance vs. Drain Current** 



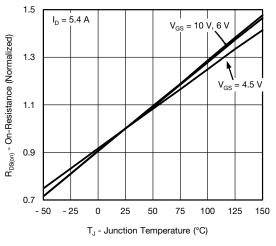
**Gate Charge** 



**Transfer Characteristics** 



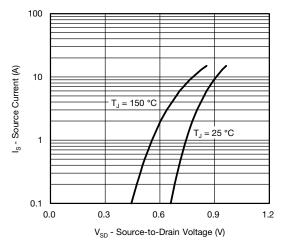
Capacitance



**On-Resistance vs. Junction Temperature** 



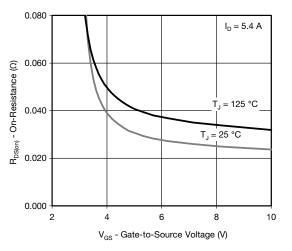
#### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



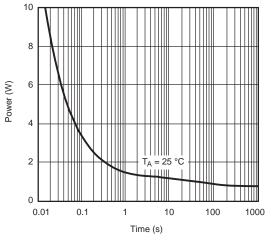
Source-Drain Diode Forward Voltage



Threshold Voltage



On-Resistance vs. Gate-to-Source Voltage



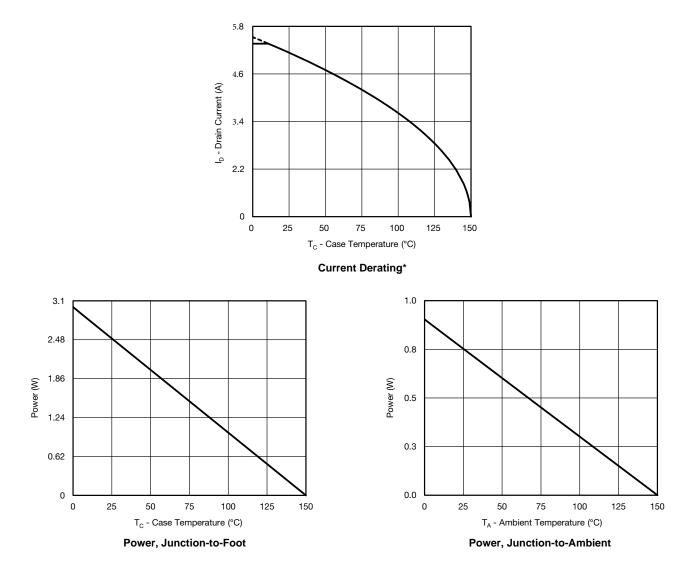
Single Pulse Power (Junction-to-Ambient)



Safe Operating Area, Junction-to-Ambient



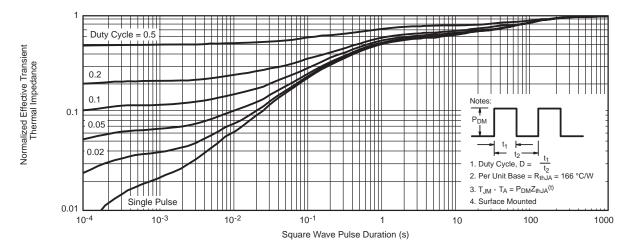
#### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



\* The power dissipation  $P_D$  is based on  $T_{J(max.)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



#### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot



#### SOT-23 (TO-236): 3-LEAD







Max   1.12   0.10   1.02   0.50   0.18   3.04   2.64   1.40	Min   0.035   0.0004   0.0346   0.014   0.003   0.110   0.083	Max   0.044   0.004   0.040   0.020   0.007   0.120   0.104		
0.10 1.02 0.50 0.18 3.04 2.64	0.0004 0.0346 0.014 0.003 0.110 0.083	0.004 0.040 0.020 0.007 0.120		
1.02 0.50 0.18 3.04 2.64	0.0346 0.014 0.003 0.110 0.083	0.040 0.020 0.007 0.120		
0.50 0.18 3.04 2.64	0.014 0.003 0.110 0.083	0.020 0.007 0.120		
0.18 3.04 2.64	0.003 0.110 0.083	0.007 0.120		
3.04 2.64	0.110 0.083	0.120		
2.64	0.083			
		0.104		
1.40	0.047			
	0.047	0.055		
0.95 BSC	0.037	4 Ref		
1.90 BSC		0.0748 Ref		
0.60	0.016	0.024		
0.64 Ref	0.025	5 Ref		
0.50 Ref		0.020 Ref		
8°	3°	8°		
_	0.64 Ref 0.50 Ref	0.64 Ref 0.025 0.50 Ref 0.026		



#### **RECOMMENDED MINIMUM PADS FOR SOT-23**



Recommended Minimum Pads Dimensions in Inches/(mm)



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